FORTRESS™

RapidFire

GAMES FROM SSI

LIMITED WARRANTY

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"One does not fortify by systems, but by good sense and experience."

— Sebastien de Vauban

Introduction

FORTRESS is a fast-paced computer game in which two rival lords seek to gain dominion over the countryside. A lord acquires control over land by building castles. He may build new fortresses on unoccupied soil or he may choose to reinforce existing structures. The strength of a castle can provide support to ally castles or it can be used to lay siege to neighboring enemy fortifications. A fortress that becomes outnumbered by surrounding opposition is destroyed. A wise lord must out-maneuver his rival by skillful deployment and through battles of attrition and direct assault.

A player may be either human or computer. He is assigned the role of the White or Black lord and engages his opponent in a series of games organized as a tournament. At the end of a tournament, a record of the wins and losses may be recorded for each contestant. If either is a computer player, the "experience" gained from competing in the tournament may also be recorded. This allows the computer player, like its human counterpart, to learn from its mistakes and adapt its strategy to the play of its opponent.

System Requirements

Atari

Atari 400, 800 or 1200 with 48K RAM
Basic Language Cartridge
5¼-inch Disk Drive

Apple

Apple II+ or IIe with 48K RAM
5¼-inch Disk Drive

Getting Started

Atari

[1] Make sure that the BASIC cartridge is installed.

[2] Turn on the disk drive and insert the FORTRESS disk.

[3] Turn on the computer and TV screen.

[4] The system will automatically load and initialize itself, then prompt you to enter your name. Do so, followed by a carriage return. The system will then display the main option menu. To begin play, type "1".

Apple

[1] Turn on the computer and the video monitor or TV.

[2] Insert the FORTRESS disk into drive 1.

[3] After loading itself into memory, the system will display the prompt "TURN OFF SOUND EFFECTS? (Y/N):". Type a "Y" or "N" followed by a carriage return.

[4] The system will next prompt you to enter your name. Do so, also followed by a carriage return. In a few seconds, the main option menu will be displayed. To begin play, type "1".

Rule Summary

The goal is to control the most territory by the end of the game.

Each player, in turn, adds a level of fortification to a square on the board. A new castle can be constructed in an unoccupied square, or fortifications may be added to an

existing castle. A castle can be built up to a maximum strength of three levels high.

An occupied square is controlled by the owner of the castle. An unoccupied square may be controlled by a player if he has more levels of fortification (strength) than his opponent in the five-square cross centered about the square.

A castle comes under siege when the strength of opposing forces equals that defending it. The castle is destroyed if there is more strength opposing it than supporting it within its cross.

Rules of the Game

Goal

The object of the game is to gain control over the most territory by the end of the game. This is accomplished by the skillful placement and fortification of castles on the playing field.

Setting

FORTRESS is a contest between two opposing forces played on a rectangular field consisting of 6 columns and 6 rows. The field is empty at the beginning of each game.

Sequence of Play

A standard game consists of 21 moves for each player. During his turn a player can either construct a new castle on an unoccupied square or fortify an existing one. A castle is fortified in three stages or levels. The first level consists of an outer wall with a guard tower at each end. Next a dominant central tower is erected, and finally the tower is topped with a heavy turret. Castles may not be fortified beyond the third level. The three levels of fortification

are shown below.

| 1 | 2 | 3 |
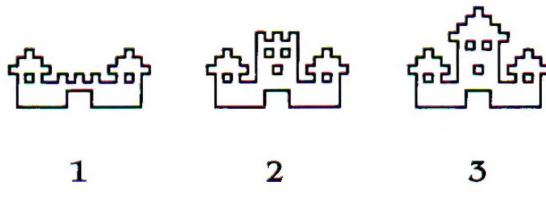
Levels of Fortification

The White lord moves first in the initial game of a tournament consisting of one or more consecutive games. In succeeding games of a tournament, White and Black alternate between moving first.

The system prompts a human player when it is his turn to move by displaying a flashing cursor surrounding the site of his opponent's last move. The player moves the cursor about the playing field using either the keyboard cursor keys or the joystick. (On the Apple II, "A" and "Z" function as the up and down cursor keys.) He selects a site to fortify by pressing the return or space keys or the joystick button. The flashing cursor turns into a solid white or black cursor, depending on the player's color, as soon as he begins to move it about the field. The player will be prompted to make another selection if he attempts to select a square which is either occupied by his opponent or is fully fortified by his own forces.

As castles are built, flags will appear in some of the adjacent squares which were empty. The flags indicate which side "controls" the square due to the influence exerted by neighboring castles. Unlike castles, flags do not indicate occupation of a square. They serve primarily to clarify the game situation by making it easier to determine the score and to evaluate field positions.
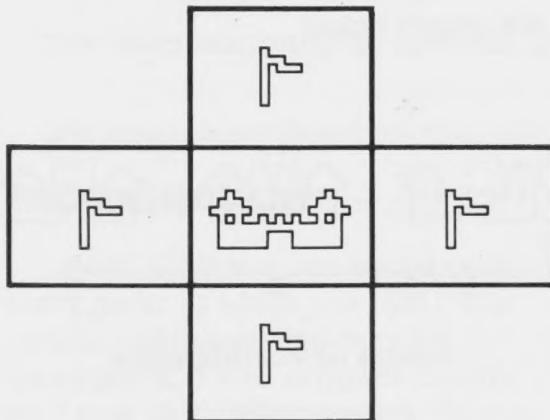
Flags About a Castle

At any point during the game, a player may press the escape key to terminate the game. If the opposing player is a computer player, he may be asked to show his recommended move by pressing the "S" key on the keyboard. The flashing cursor will be displayed at the new board position, which the human player may select if desired.

Zones of Control

A castle's level of fortification determines its strength. Each castle exerts influence over the square it occupies and the four squares adjacent to it. Thus the castle has a zone of control that covers the five-square cross surrounding it, as shown below. This strength is used to control territory, support friendly units, and destroy opposing castles within its zone of control.
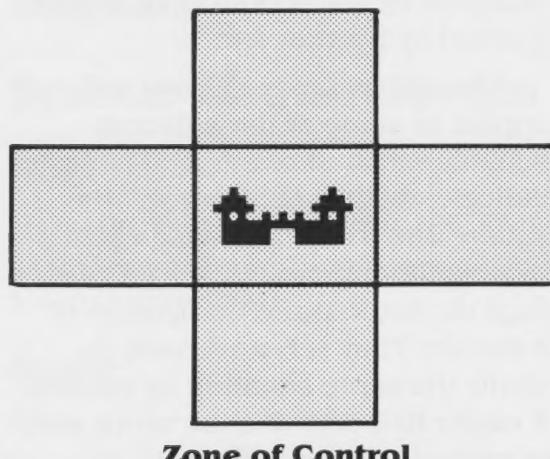
Zone of Control

Overlapping zones of control of ally units add together. Zones of opposing forces cancel each other when they overlap.

Controlling Territory

A square is controlled by a player if it is occupied by one of his castles or if he exerts more strength over it than his opponent. Flags indicate which side controls the unoccupied squares. The exact strength exerted over an empty square can be found by counting the levels of fortification in the four squares surrounding it. This is equivalent to adding up the strengths of all the units in the zone of control of the square in question, as illustrated in the following figure.
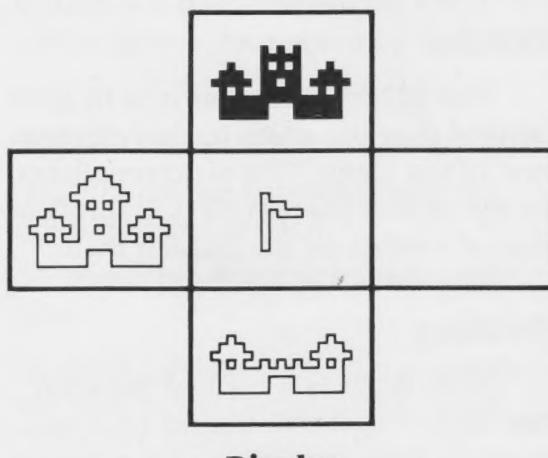
Display
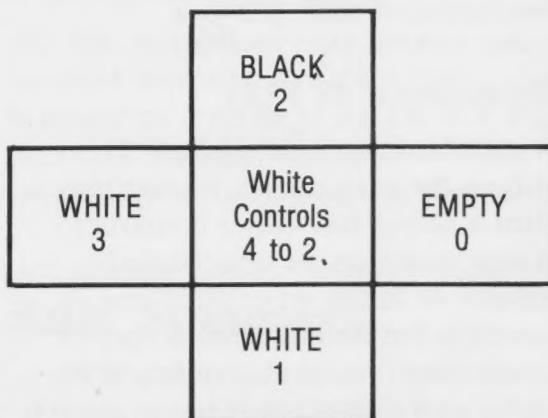
Strengths

In this example, the White lord controls the center by exerting a

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strength of four to two over it.

Flags appear and vanish as control over territory changes hands. Although it is not usually a wise move, castles may be contructed in squares containing an opponent's flag.

Scoring

The current score is displayed at the bottom of the screen throughout the course of the game. It may be derived from the playing field by finding the total number of squares controlled by each player (i.e., those squares containing their castles or flags). Although the score is informative, it only becomes significant at the end of the game.

Castles Under Siege

A castle comes under siege when the total strength of opposing units equals the combined strength of defending forces in the five-square cross about it. A castle under siege is threatened and may be destroyed on the next turn if it is not reinforced. A threatened castle can be supported by adding an ally unit to any allowable square in the cross, including its center.

The system displays a warning of a state of siege by closing the gate (drawbridge) of the castle under attack. This visual cue lets the defending player see which of his forts are in danger without having to tally the strengths in each of his

castle's crosses. As an option, this warning can be turned off to provide a more challenging game that requires greater concentration and provides more surprises.

It is important to realize that each castle has its own cross, and that it is the balance of power within the cross that determines whether or not the unit will survive. For purposes of defense, consider the strength of the cross about your own units. When attacking, look for weaknesses in the cross about your opponent's fortifications. It takes some practice before the positive and negative views of the board formations become distinct and recognizable, especially when the siege warning option is turned off.

The Destruction of Castles

A castle is destroyed when it is outnumbered by enemy fortifications in its cross. This situation occurs when the total strength of opposing units is greater than the strength of allied forces in the castle's zone of control. All units in the five-square cross are counted. The levels of fortification at the center and those of adjacent allied units provide support. Only enemy fortifications within the cross pose a threat.

In the following illustration the castle at the center is overpowered in its cross by a strength of five to four. As a result, the two level castle at the center is destroyed.

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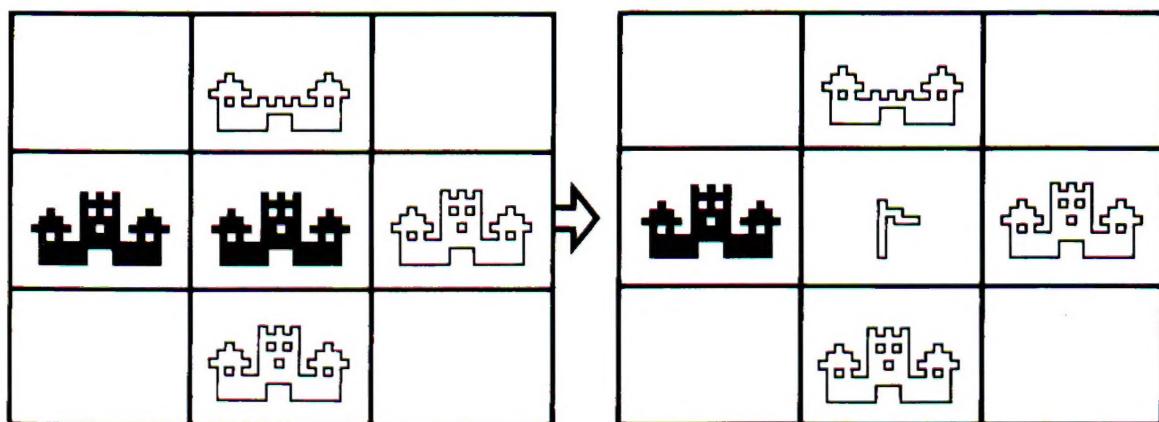
If a castle occupies a square at one of the corners or the edge of the playing field, its cross will have less than five squares. These positions are easier to defend than interior squares.

When a castle is first constructed, the strength of opposing units in its zone of control are examined. Only after the vulnerable enemy castles are removed is a test made to determine the survival of the newly entered piece. This is referred to as the first strike advantage and is covered in detail in the section on Special Situations below.

End of Game

The standard game ends after 21 turns, although this number can be altered via the option menu. The player with the highest score is the victor. A player's score indicates how much territory he has acquired during the game. The degree of success is measured by the difference between the scores of the two players. If both players hold the same amount of territory the game is a draw. It is possible to have squares which are not under the control of either player at the end of the game, so that the combined score may not always sum to thirty-six.

Special Situations

Fuses

When a castle is destroyed it may leave some of its neighboring allied fortifications outnumbered in their own crosses. These structures are in turn removed, and the process continues until there are no unsupported castles left on the board. A configuration of units vulnerable to such an attack is referred to as a fuse.
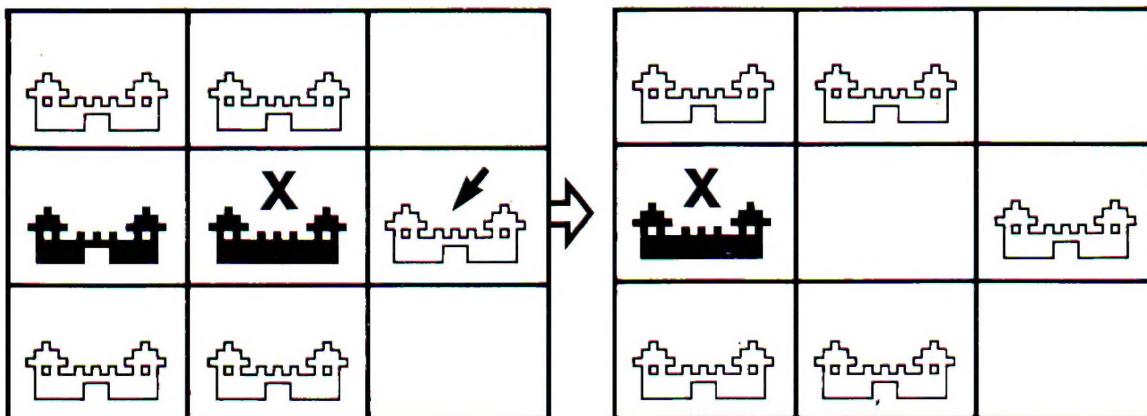
A Fuse
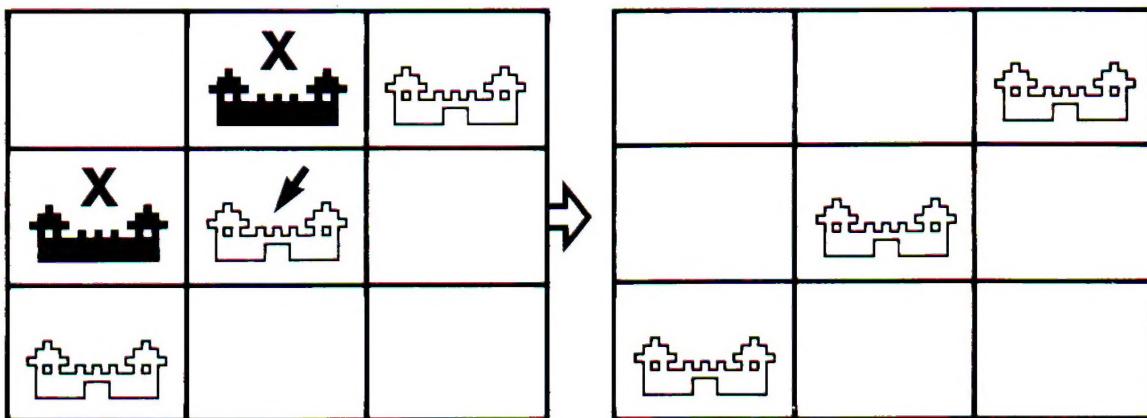
First Strike — a Stable Result

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First Strike

When a structure is placed, any adjacent opposing fortifications that become outnumbered are eliminated before the new unit is considered for removal. This is called the first strike advantage. A first strike can produce a stable result, a vulnerable result, or a sacrifice, as described below.

A stable result occurs when the first strike leaves the castle in a safe situation where it is not vulnerable to immediate counter-attack.

Alternatively, the newly erected fortification may survive the initial strike, but it may be vulnerable to immediate counter-attack at the completion of its turn, as shown below.

Finally, the unit may successfully destroy an opposing fortress, but be immediately taken because it is outnumbered in its cross. This is known as a sacrifice.

Cycles

Both the vulnerable and sacrifice situations can lead to a series of moves which repeat themselves. Such a cycle arises when both players contribute to recreating the pattern of continuously building and destroying fortifications. Since the game is limited to a finite number of moves, a cycle cannot repeat itself indefinitely. It is up to the discretion of the players as to how many moves are consumed in this manner.
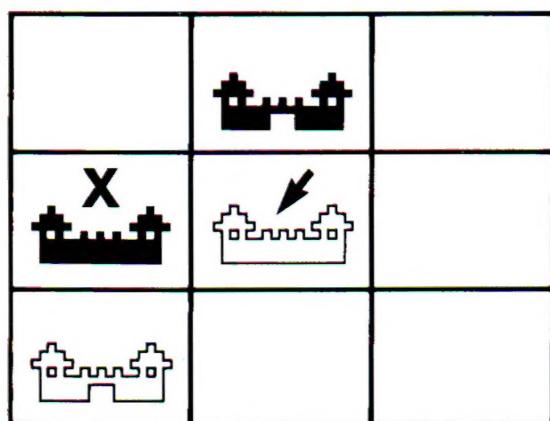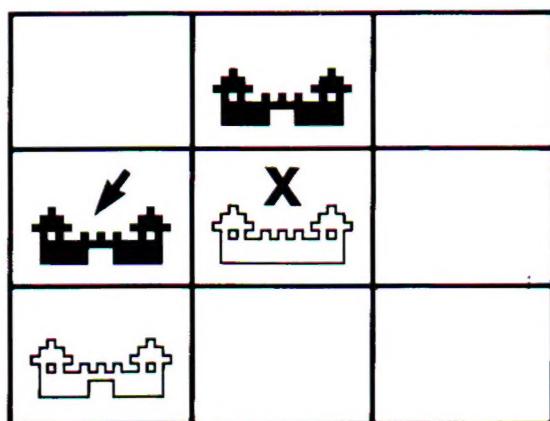
| Move | Counter Move |

First Strike — a Vulnerable Result
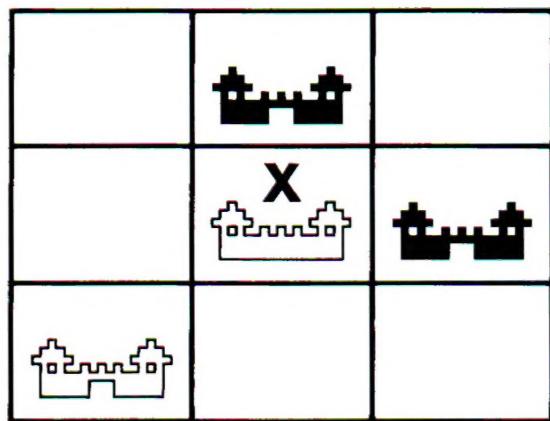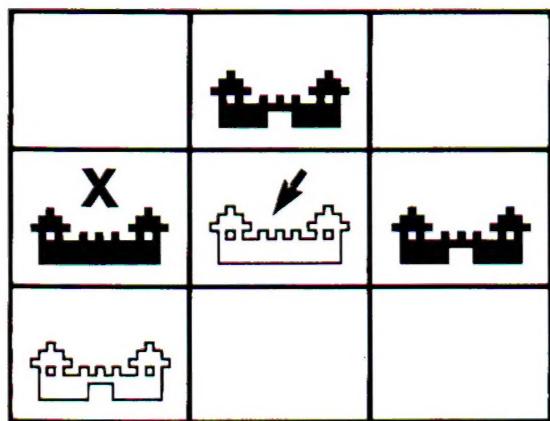
Completion of Move

First Strike Sacrifice

No Construction Sites Open

In games consisting of more than 27 turns the player holding the least territory may find that he has no legal moves left on the board. All of the sites occupied by this player are already fortified to the third level and all other squares are occupied by enemy castles. In this case the player must forfeit his turn. If the player is human, his cursor will not be displayed and his opponent will continue to build until legal moves become available to the player at a disadvantage. (When one of his castles is taken, he may move into the vacated site even though destruction of that piece is inevitable.) When the computer has no legal moves, the cursor will reappear where the human player made his last move, prompting him to take his turn.

An Initial Walkthrough

At this point you should have a feel for the game and how it is played. Before going into the details concerning the selection of players and other game options, let's walk through the sequence of events involved in entering FORTRESS and playing a sample tournament. We recommend that you follow along at your computer as you read this section. Although only the FORTRESS master disk is required to play the game, a separate formatted diskette is also necessary if you intend to record the results at the end of the tournament.

A few seconds after booting the FORTRESS master disk a title page is displayed to the tune of the FORTRESS theme song, "Men of Harlech". (Harlech is a medieval castle in Wales, and the tune is that of an old Welsh battle hymn.) When a keystroke is entered the music will stop and, if your computer is an Apple, the prompt "TURN OFF SOUND EFFECTS? (Y/N):" will appear. Type "Y" only if you don't want sound effects while playing a game. This question is not asked if you are on an Atari, since you can control the volume of the sound effects which are produced by your TV. The system then prompts you to enter your name. Do this, followed by a carriage return. Don't worry about entering illegal characters — the system won't let you!

It is important to keep the FORTRESS master disk inserted in your drive throughout the system initialization. Initialization is complete when the option menu appears on the screen. You may remove the FORTRESS disk at any point hereafter, but leave it inserted for now.

The menu, which should be currently displayed on your screen, allows you to prepare for the upcoming tournament. A tournament is a series of up to 15 games. As the menu items indicate, players may be selected, copied (or created), removed, and their histories reported. A roster of the players residing on the currently inserted disk may be displayed by pressing "3" on the keyboard. (Appendix A contains a description of these players.) If you do this now, DISPLAY ROSTER will highlight and the menu will be replaced by a list of the players provided on the FORTRESS disk. The (C) after each name indicates that it is a computer player. Press any key to get back to the menu.

Notice that the name of one of the players in the roster, COUNT VAUBAN, is displayed in the text block above the menu along with the name you entered earlier. This indicates that Count Vauban is the current Black player and you are the current White player. The (H) after your name reminds you of your humanity.

Menu items 7 and 8 allow you to set two game options: the length of the game in turns, and whether warning is to be given, by means of closing castle gates, when a unit is under siege. The current settings of both options are also displayed in the state description above the menu. As you can see, the default game length is 21 turns, and siege warning is enabled.

For now, let's go with the default tournament settings and press "1" at the keyboard to begin play. The screen will clear and the playing field appear. The text displayed beneath the game board identifies the current turn number (1) and score (0 to 0). If your computer is an Apple, the number of the current game in the tournament is also displayed. (The game number is displayed at the end of each game on the Atari.) Finally, notice your name printed in the text area and a flashing white rectangle on the game board. This is your signal to make a move.

A unit is placed by positioning the cursor over the desired square and pressing one of the select buttons. There are two ways to position the cursor. You may use the four cursor control keys on the keyboard (use "A" and "Z" to move the cursor up and down on the Apple II), or if you have a joystick it may be used. In either case a click sounds as the cursor moves over each square. When you are through positioning, press the return key, space bar, or joystick button to make your selection. The cursor immediately disappears and a white castle is erected in the square, surrounded by white flags indicating the castle's zone of control. Notice that the White score has changed from 0 to 5.

The name of your opponent, Count Vauban, appears in the text area of the screen as he prepares to

make his move. In a few seconds, a black castle appears in one of the vacant squares, surrounded by black flags in the adjacent squares. Depending on where the Count moved, one or two of your flags may have disappeared, indicating that those squares are now neutral territory. The flashing cursor identifies your opponent's last move (especially useful when the board begins to fill up) and is your prompt to make the next move. The score, turn number, and name are updated to reflect the new board situation.

Let's continue. When your opponent is a computer player, as in this case, you may ask him to suggest the best move by hitting the "S" key on the keyboard. The cursor will be disabled momentarily, then reappear at the recommended board position. Try making an illegal move, such as attempting to place a castle on a square occupied by Black forces or fortifying one of your castles to a level higher than 3. The system will sound a horn and flash the cursor, prompting you to try again.

The game is over when you and your opponent have each made 21 moves. A summary of the game is displayed in the text area at the bottom of the screen. Don't be upset if Count Vauban won — he lost his first game too. At this point, you may either press the escape key to end the tournament, or you may press any other key (including a joystick button) to play another game. For now, hit any key but escape. After a moment the board will be redrawn. This time around Count Vauban moves first (players alternate moving first each game within a tournament).

You may play up to 15 games within a single tournament. A game in progress may be terminated at any time by hitting the escape key. The system will ask you whether you wish

to end the tournament or begin a new game. The score from an aborted game is not saved and the tournament continues as if it had never taken place.

When you have completed at least one game, press escape to end the tournament. The game board will be cleared and the Tournament Results screen drawn in its place. This screen gives a summary of the games played in the tournament and provides the option of recording these results for each contestant. The system first asks if it should record your history. If you enter "Y", you will be prompted to insert a disk (which should be formatted and write-enabled) and verify the action. If you also answer "Y" to the verification question a history file under your name will be saved on the disk. If you answer "N", the action will not be performed.

The system next asks if it should update Count Vauban's history. Since the Count is a computer player, you will also be prompted to update his learning. Like human players, a computer player gains experience from every game he plays. He will only "remember" what he has learned, however, if this experience is recorded on disk. If you have a formatted player disk, type "Y" to record Count Vauban's history and strategy tables. As before, the system will remind you to insert the disk into the drive prior to writing.

When player files are written to a newly formatted disk, the system has to first create a player roster and then create new player files before saving the history and strategy tables. Screen messages are displayed as it performs these operations. If you had instructed the system to update Count Vauban's learning on your formatted player disk, you would now have your own copy of Count Vauban

which is somewhat different (because it has played against you) than the one residing on the FORTRESS master disk. When you get back to the menu, if you request the system to display the contents of the roster residing on your disk you will see two names: yours and Count Vauban's.

At this point the system will prompt you to hit any key to return to the menu. Your have now come full circle and are ready to set up conditions for playing the next tournament. In the next section we shall cover the other menu operations in greater detail so that you will be able to select new players, review their history, and specify the various game options.

The Menu

Menu operations are performed by pressing the key corresponding to the desired item. The system acknowledges the selection by highlighting the associated item, then displays one or more prompts beneath the menu to guide you through the operation. In general, carriage returns are required only when the input involves multiple characters, such as typing player names or the number of turns in a game. In these instances, limited line editing is supported (e.g., backspacing over characters) and the system protects against invalid characters.

Most of the menu items involve player operations, such as selection, copy/creation, removal, and history reporting. Information concerning players is stored on disk and is accessed by the system via the player roster, which is a directory of the players residing on that disk. You may view the contents of the roster by invoking the DISPLAY ROSTER command. Player information includes

a history of past tournaments and (for computer players only) a table which governs its playing strategy.

Defaults exist for all game options, so that if you simply want to play a series of games with Count Vauban (the default computer player) you need not spend time in the menu.

In general, any menu operation can be aborted by entering carriage returns in response to the prompts. The only prompts which demand precise responses are the Yes/No (Y/N) and Human/Computer (H/C) prompts. Do not append a carriage return to these — a single keystroke is sufficient.

FORTRESS is careful about error detection and recovery. If you mistype a player's name, it will give you the opportunity to reenter the name or insert another disk. It detects all disk-related errors and advises you on how to correct the problem.

We recommend that you DO NOT attempt file operations on players (e.g., copying and deleting history and strategy files) by means other than those provided by the menu. The integrity of the system may suffer as a result. This warning especially holds true for the player roster, since deleting the roster from a disk will make all the players on that disk inaccessible to the system. We do, however, recommend that you back up player disks using the standard disk copy facility provided by your operating system.

The following sections describe each command in detail.

[1] BEGIN PLAY

This command begins a new tournament. You will usually return to the menu from the Tournament Results screen, which is displayed at the end of the tournament. If you end the tournament, however, without

playing a single complete game (by pressing escape twice during the first game), you will bypass Tournament Results and return directly to the menu screen.

[2] CHANGE PLAYERS

New contestants are selected using this command. The system will first prompt for the name of the White player, followed by the name of the Black player. If you do not wish to change one of the players, just enter a carriage return in response to the prompt.

When you enter a player's name, you will be required to specify whether it is human or computer. (This is necessary since a human player may have the same title as a computer player.) The system will attempt to read a computer player's strategy tables into memory. If the player's name is not currently on the roster, you will be asked to verify that it is a new player. A new computer player's strategy tables are initialized to zero, but no information is stored on disk at this time. You may also notice that a new player's name does not appear on the roster. This will only happen after his history and/or strategy tables have been saved on disk, either via the COPY command described below or the Tournament Results screen.

The two contestants may be both human or both computer. They may even be the same player (On the Atari, joystick port number two should be used by the second human opponent). A good way to learn the mechanics of the game is to play yourself, since you then have complete control of the board situation and can try out some of the special situations like fuses and first strikes which occur rarely in actual play. It is also interesting to watch two computer players battle one another. It

may be a fun challenge to train your own computer player and pit him against a computer player trained by your friend.

[3] DISPLAY ROSTER

This command displays the player roster resident on the currently inserted disk. If there is no roster, the system will first create one (it will do this during execution of any command in which the roster is accessed). Names will be displayed one screenful at a time until the end of the roster is reached. At any point you may press escape to return to the menu or any other key to view the next screen. The roster may contain up to 50 players, assuming there is sufficient room on the disk for them.

[4] REPORT HISTORY

This command is used to view a player's tournament history. The system will prompt you to enter the player's name and type (human or computer), then read the file into memory. The history file contains the results for up to 30 of the most recently recorded tournaments. Once the file is in memory, tournaments are displayed one per screen, beginning with the most recent. You may scroll forward or backward through the file by hitting the "F" and "B" keys, respectively. When you are finished viewing the history, press the escape key to return to the menu.

[5] COPY PLAYER

This command is used to either create a new player or to make an existing player identical (as far as history and playing style) to another. The system first prompts you for the name of the "source" player, then it prompts you for the name of the "destination" player. If you wish to

create a brand-new player (one that you can train from scratch), enter only a carriage return in response to the "FROM:" prompt.

When copying a player, you are in a sense creating a "clone" of that player. The two players will have the same history and, if they are computer players, identical strategy tables. The COPY command, together with the REMOVE command described below, provides a convenient way to back up player files and move a player from one disk to another.

If the destination player already exists the system will ask you to verify the copy/create operation. This is to prevent you from inadvertently destroying a previously existing player.

[6] REMOVE PLAYER

This command deletes a player's history and strategy files and removes its name from the roster. If the player does not exist, you will be given the opportunity to reenter the name, insert a new disk, or abort the operation.

[7] SET GAME LENGTH

This command allows you to specify the number of turns in a game. The valid range is between 1 and 54, with 21 turns standard. In practice, the game begins to lose momentum after around 30 turns, and fewer than 15 turns doesn't give the contestants sufficient time to develop the board. It is useful, however, to begin training a novice computer player using very short games (3 to 9 turns), since this allows him to learn specific concepts more quickly.

[8] SET SIEGE WARN

This command controls the setting of the SIEGE WARNING option.

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Each time the command is invoked, the option is changed from "ON" to "OFF", or from "OFF" to "ON". The current setting is always displayed in the text block above the menu items. SIEGE WARNING functions as a visual aid for human players. When it is enabled, a castle gate will shut when the fortress is vulnerable (i.e., susceptible to being destroyed by the enemy), and reopen when it becomes safe again (by means of additional fortification or support from neighboring ally forces). Playing with SIEGE WARNING turned off requires greater concentration by the human player, since he must either continually count strengths or learn to recognize the build-up of forces. Most players appreciate the visual cues provided by the opening and shutting gates, but it is interesting to experience the different flavor of a game without them.

Strategy

The object of the game is to gain control over territory. This should be performed as efficiently as possible, since both sides have limited resources with which to build. One must understand how to engage the enemy both defensively and offensively to win. Mastery of the game comes only when these strategies can be applied to carve out and secure territory.

In a standard-length game (21 turns) the early moves should focus on staking out territory. By the middle of the game, a player begins to invade his opponent's territory in order to diminish his realm and battles are waged over contested squares. Many games end in the entrenchment of forts along the boundaries between opposing forces. Sometimes there is still open territory on the board to be claimed because the players are engaged elsewhere on

the board. Limiting the number of turns adds an element of timing to the game and discourages the mindless buildup of forces.

An approach which is instructive in learning strategy against an opponent is to play a series of short games against a novice computer player. This approach also allows you to see how a computer player learns the game. A brand-new computer player is easily created using the CHANGE PLAYERS menu command by entering a name which is not already in the roster. The new player will initially make random moves, but he will begin to learn the basics after the first several games. The strategy tables used by a computer player are updated (in memory) at the end of each game. It is important to update his learning (to disk) at the end of each tournament if he is to retain the experience gained.

Several important aspects of the game can be encountered within a short time. A game consisting of only one turn each is trivial. A player is ensured no worse than a draw if he builds a castle away from the edge of the playing field. A three-move game is a good starter. It is easy to destroy a castle of an untrained opponent by placing two of your forts next to it. It is not necessary to support the first attacking piece because the computer player doesn't know yet how to retaliate. He will learn soon enough. At first he will attempt simple-minded (unsupported) attacks of his own which can easily be repulsed. As he observes the way you fend off his crude assaults he learns to defend himself. After this point, only properly supported attacks can be made without an immediate counter-strike.

Three moves are sufficient for a properly supported attack. First a unit should be placed next to an enemy's flag (not on the flag) to

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cancel the opponent's influence and thus provide support for the next move. Your next move should be made into this square next to the enemy unit. On the third move the enemy castle can be taken by moving anywhere within its cross. Of course, all this assumes that the enemy does not reinforce his fortress during the assault.

Within ten to fifteen short games, your novice computer opponent should know how to defend and counterattack when necessary. Since such short games afford little opportunity for extended sieges, there is not much more that can be done by engaging the enemy directly. At this point it is best to turn your attention to the overall battlefield strategy. Observe that the best way to rapidly acquire territory is to place your castles so that their crosses fall entirely within the board but their crosses do not overlap. It is equally valuable to neutralize enemy-controlled territory as it is to gain your own. Even in extended games, the opening moves are generally used to stake out territory. After applying this strategy for several more three-move games you and your opponent will begin to tie consistently and you will be ready to move onto the next level.

A game of length seven or nine is recommended for the next level of analysis since it allows for more experimentation in engaging the enemy. It is worthwhile at this point to make the object of the game the destruction of an enemy fortress without losing the rest of the board completely. Obviously pieces on the side or at the corner of the playing field are harder to attack because they have fewer exposed flanks where force can be applied. The defensibility of these positions compensates somewhat for their lack of neighboring

squares to dominate. If the computer player seems to be ignoring the attacks after several games, it is because he is fixed on a single goal: seize territory and win the game. Once you feel comfortable taking castles, it is time to get back to this more noble objective.

In very short games, ties are easy to achieve by either player. In somewhat longer games (7 to 9 turns) the player that moves second has an advantage because he has more freedom in placing the last piece. As the length of the game increases the first player to move gains an advantage because he generally has more strength on the board and a greater initiative. Initiative is a very important aspect of the game. A player has initiative when he can select his moves but his opponent must respond to them or forfeit significant board strength. An experienced player can use initiative to control the flow of the game. For example, by bringing pressure to bear on an exposed unit the enemy can be forced to support it with a dense and inefficient packing of units. In this way, the enemy can be herded into a corner where its strength is used for support and not to dominate unoccupied territory.

Another technique that can be applied is known as a fork. A fork occurs when the enemy is placed under siege at several sites so that not all of his threatened castles can be reinforced by a single move. The most frequently occurring fork arises when enemy units on opposite sides of a castle are besieged. The best response to a fork is to support one of the threatened units while also threatening the opponent. In this case the instigator of the fork must choose between taking or losing a castle. In some instances, when there are many units on the verge of siege, a fork can set off a series of

other forks. This is a very effective method of diminishing the enemy's forces. On the other hand, it is not easy to set up a fork from scratch and it may prove to be a waste of resources.

A standard length game (21 turns) allows application of the full range of strategies. A player may choose to play defensively and sweep out territory, engaging the enemy only when attacked or infiltrated. Alternatively, he may play aggressively, constantly seeking a fork or break-through to capture chunks of territory. The aggressive player must rely on initiative, while the passive player invests in board position. The ideal strategy encompasses both. Thus, a single move could be used to pin the opponent into defending real estate of little value, while the piece played gains control of a large swatch of territory and a key board position.

The first time you play a 21-move game it is probably best to be defensive. Consolidate territory early, so you don't have to worry about nasty surprises. Then infiltrate the enemy's weak points and do as much damage as you can. A simple defensive pattern is that of taking half the board, either horizontally or vertically. Of course, your opponent will try to stop you, so be flexible. More sophisticated approaches emphasize taking

the center of the board to divide the enemy forces (hoping for forks), or building a chain of fortresses one square away from the side of the board. The squares along the diagonals, between the center and corner squares, are quite useful in developing the second approach. There is no single best strategy to use, however, so experiment and experience.

It may be comforting to know that the computer opponent does not know the best strategies either. In fact, his strategy tables are rather limited and he will never learn to play a perfect game. As compensation, however, a computer player can rapidly adapt his strategy in response to his opponent. It is therefore fairly difficult to beat a learning computer player by a significant margin over a series of games. That is the real challenge. To accomplish this you must be able to vary your technique in order to keep one step ahead. The most effective strategy to use depends on the experience and approach of the opponent you are playing at any particular time.

Acknowledgements
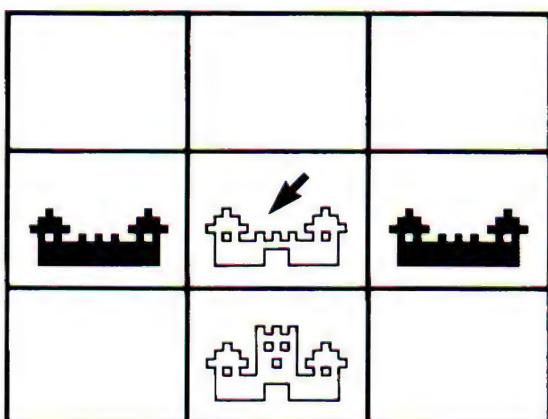
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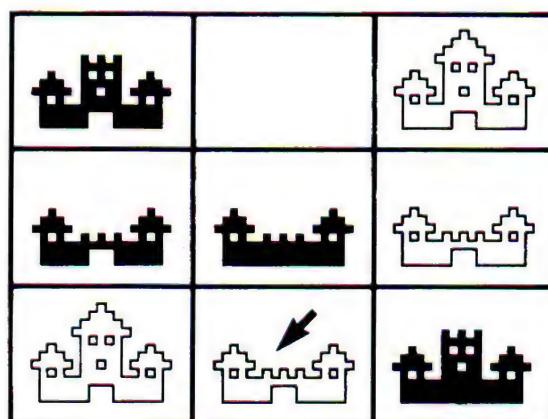
Diagonal Fork

software tool packages which facilitated the development of FORTRESS on the Apple computer. The shape table editor from Beagle Bros' *Apple Mechanic* was used to implement the graphics, and the sound modules were created using subLOGIC's *Music Maker* package.

A special note of gratitude is made to Professor Peter Bock of George Washington University, whose teaching and encouragement in the field of adaptive learning algorithms provided a basis for the game's development. Additional thanks are extended to Edward and Kay Templeman for their support and suggestions throughout the entire project.

Credits

Game Design & Programming
Jim Templeman and Patty Denbrook

Art & Graphic Design
Image Creations

Typesetting
Abra Type

Printing
A&a Printers and Lithographers

Appendix A.

Supplied Computer Players

The following computer players are supplied on the FORTRESS master disk, each possessing a different level of ability or playing style. It is fun and instructive to play these different opponents in order to gain an appreciation of the variety and subtlety inherent in the game.

Count Vauban

Count Vauban is the default computer player which is loaded into the system upon initialization. He is an advanced player incorporating a well-rounded set of both defensive and offensive playing techniques. Although not a perfect player, Count Vauban plays a challenging game with even highly skilled human opponents and is a good place to start in training your own champion computer player.

The Squire

The Squire, as his name suggests, is a rank novice computer player. He will make random and often ridiculous moves during his first few games, but with careful training will begin to learn simple strategy. Refer to the section on Strategy, which outlines an approach to learning the game using a novice computer player. The Squire is also a good place to start for those who wish to train their own computer player from scratch.

Sir Galahad

Sir Galahad is an intermediate computer player. He has played about 90 games against a skilled instructor, and is at a level where he plays fairly well (i.e., does not make many obvious mistakes) but has not yet incorporated a well-developed set of playing strategies. He is a suitable opponent for a player who is familiar with the game but not yet advanced enough to successfully compete against one of the more advanced computer players.

Genghis Khan

Genghis Khan is an advanced player who, like his namesake, exhibits a number of aggressive tendencies. He has been trained to attack, and will engage his opponent's forces at every opportunity (although not always to his ultimate benefit). Be careful when playing him, though. Some of his offensive tactics can be subtle, such as setting up forks and enveloping his opponent.

Lord Maginot

Lord Maginot is an advanced player who takes a more defensive posture. His playing strategy concentrates on staking out territory, then defending it against attack. A common tactic employed by Lord Maginot is to protect territory from invasion by building a wall of forts. Like the famous Maginot line of World War II, this strategy may not always succeed in the long run. See what tactics you can come up with to infiltrate Lord Maginot's defenses!

Appendix B.

Learning

The learning and decision-making techniques employed in FORTRESS are simple, yet effective. The approach is remarkable primarily in its ability to achieve its speed and quality of learning with a minimum of logic and storage requirements. The system uses a table of weights to compute the value of each allowable move for a player, so that the "best" choice can be made. If there are several choices with the same maximum value, then a random selection is made between them. Only twenty six weights are used. They describe three characteristics of a move as it relates to the current board situation. These characteristics are: the state of the cross about the square being considered, the state of the crosses of immediately neighboring squares, and the square's absolute position on the board. For each potential move, the current weights for each of these characteristics are summed to find the total value of making that move.

When a new computer player is created, the value of all of its weights are set to zero so that a random set of choices will be made. Learning is accomplished by adjusting the weights at the end of each game. The weights associated with the choices made by the winner are increased, while those of the loser are diminished. The hope is that this method of adjustment will, in time, increase the weights associated with making good moves. Since FORTRESS is a non-trivial game the "best" set of weights is not known. A measure of the degree of success of this technique may be found by observing the quality of play exhibited by the program as it plays a series of games. You are invited to judge for yourself.

As the system plays a series of games against a good player its weights will change and become less equal, causing it to adapt to its opponent's strategy and tactics. The system is constrained to consider only those aspects of the game associated with the twenty six weights it uses. It will pick up most strongly on the choices made by the superior player which are different from its own when the superior player wins a series of games, or when he wins a single game by a large margin. The computer player can also apply its system of evaluation to novel game situations. When the computer player wins a game, it will reinforce those techniques, via its weight table, which distinguished its play from that of its opponent. Thus it goes beyond the simple copy-cat method of learning.

When a computer player encounters the same opposing strategy repeatedly it will specialize its weight table and may, in time, develop a somewhat rigid playing strategy. If it plays a variety of opponents or strategies (i.e., a non-stationary environment) it can readjust its approach. A computer player could take longer to adapt if its weights were overly specialized to the previous opponent. This raises the question of whether there exists a "best" set of weights that would consistently win against a variety of opponents, and if the best strategy is to use a rigid or more adaptive technique. It will be interesting to see the results of real-world experimentation, particularly in the form of tournaments involving competing computer players.

A basic internal metaphor used in the design of the learning and decision-making algorithms is that of a single neural circuit within an organic nervous system. Researchers have hypothesized that some forms of learning take place in a neural network by the development and atrophy of synapses which transmit signals between neurons. Similarly, learning in the game takes place by increasing and diminishing the computer player's weights, where each entry in the weight table is analogous to a synapse attached to a neuron. A synapse's influence on the neuron may be either excitatory or inhibitory, just as a weight may be positive or negative. Only a specific set of synapses are active when examining a specific board position. If the synapses have grown properly, good choices will elicit a stronger response by activating the more potent exitatory synapses, which in turn make the neuron fire more frequently. The single decision-making "neuron", with its twenty six synapses, is the adaptive decision-making part of the system. It is supported by software logic that preprocesses the view of the board to feed into the circuit and finds the maximum response of the summation process.

The description above explains how a hypothesized working of a neural circuit was applied as a metaphor in devising the adaptive approach. The game is not meant to be a simulation, nor is it meant to support one model of neural adaptation over another.

Appendix C.

Men of Harlech

The following are the words to FORTRESS's theme song, *Men of Harlech* (for those who would like to sing along!).

1. Men of Harlech, in the hollow,
    Do ye hear, like rushing billow
    Wave on wave that surging follow
        Battle's distant sound?
    'Tis the tramp of Saxon foemen,
    Saxon spearmen, Saxon bowmen,
    Be they knights, or hinds or yeomen,
        They shall bite the ground!

    Loose the folds asunder,
        Flag we conquer under!
    The placid sky now bright on high
        Shall launch its bolt of thunder.
    Onward 'tis our Country needs us,
    He is bravest, he who leads us,
    Honor's self now proudly heads us,
        Freedom, God and Right!

2. Rocky steeps and passes narrow
    Flash with spear and flight of arrow,
    Who would think of death or sorrow?
        Death is glory now!
    Hurl the reeling horsemen over,
    Let the earth dead foemen cover;
    Fate of friend or wife or lover
        Trembles on a blow.

    Strands of life are riven,
        Blow for blow is given
    In deadly lock or battle shock
        And mercy shrieks to heaven!
    Men of Harlech, young and hoary,
    Would you win a name in story,
    Strike for home, for life, for glory,
        Freedom, God and Right!

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